CURRENT AND HISTORICAL SEDIMENT LOADS IN THE LOWER MISSISSIPPI RIVER

Second Interim Technical Report

by

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14. ABSTRACT

Questions concerning past, present and future temporal trends in the sediment load of the Lower Mississippi River are relevant to the redistribution of available Mississippi River sediment as part of efforts to reduce loss and restore coastal lands in Louisiana. The aim of this project is to compile a comprehensive data base on measured loads in the Lower Mississippi River and supply the evidence base necessary to inform debate on the way that sediment loads have changed through time. Results from this research will then inform plans to divert water and sediment out of the river to support coastal wetland enhancement and rehabilitation in the delta.

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SEDIMENT LOAD REGIONAL SEDIMENT MANAGEMENT

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Administrative Actions

During the second phase, normal administration of the project continued with contractual matters dealt with by administrative staff at the University of Nottingham, Halcrow and Cottonwood Consulting. There were no changes to staffing or other non-routine administrative actions.

Technical Work performed in this Reporting Period

Aim

The aim of the research is to compile a comprehensive data base on measured sediment loads in the Lower Mississippi River and supply the evidence base necessary to inform debate on the way that sediment loads supplied to the coastal area of the Gulf Coast have changed through time. Results from this research will also inform plans to divert water and sediment out of the river to support coastal wetland enhancement and rehabilitation.

Scope of Work

The contract sets out the SoW for the project in four phases. During this reporting period, work continued in Phase 1, as set out in the contract:

Phase I. Data Assembly and Reduction

1. Assemble as complete a data base of historical sediment transport data as possible, building on the data set compiled by Thorne et al. (2001) through data tracing, accessing, assimilation and entry into the master data base extending (if possible) from the time of Humphreys and Abbott (1861) to the present day.
2. Contact other parties who hold or have reported sediment transport data and attempt to acquire this for inclusion in data base – subject to stringent quality control and validation.
3. Add recent data from routine gaging on the Mississippi River to bring the data base as up to date as possible.
4. Compute best estimates of sediment loads at gage stations along the river, with appropriate uncertainty analyses and representations to represent multi-error sources.
5. Collect any existing sediment load data gathered at major diversions that presently exist along the Mississippi River (for example: Old River).

The project continued, following the schedule set out in the GANTT Chart (Appendix 1). Further progress was made by the team through joint initiatives on data gathering and entry in the US and UK in Task 1, resulting in an updated data base. Updated inventories of data in the data base for pre and post-1930 periods may be found in Appendix 2.

Task 2 has been addressed by the team with active support and participation by Mr

Knuuti of ERDC. Further visits have been made to potential data sources in Mississippi and Louisiana and the availability of sediment data has been deeply explored. Task 3 has been completed by Halcrow/UoN/Cottonwood and a start has been made on Task 4. This has revealed some concerns over the accuracy of loads routinely computed by the USACE at some stations and further investigations are being undertaken to assess the uncertainty associated with these computations, based on recalculation of loads by Halcrow using the raw data obtained from the USACE by Cottonwood Consulting.

Under Task 5, Cottonwood Consulting have worked to trace existing data from diversions, but the outcomes have been disappointing in that no measured data exist at many diversion locations.

Work has also been performed to initiate Phase 2 as specified in the contract:

Phase II. Historical Trend Analysis

6. Establish historical trends in annual sediment loads during the 20th century and reconcile these against published accounts.
7. Determine current sediment transport rates and historical trends at sediment gaging stations along the river and, where possible, reconcile these against published accounts.
8. Use any data available from existing diversion sites to quantify sediment discharges out of the Mississippi River and quantify sediment performance and balance at existing diversions.
9. Perform the statistical analyses necessary to estimate error bands and evaluate the confidence that may be placed in time trends and diversion performance, given uncertainties in the historical data.

Specifically, planning meetings to design the statistical analyses necessary to achieve Tasks 6 and 9 have been held between Halcrow and University of Nottingham. As noted above, initial work on computed sediment loads has raised some issues concerning the way that loads are calculated and the uncertainties involved and these must be resolved before Task 7 can be undertaken. Based on the findings of Task 5, the scope of Task 8 will be limited by data availability.

Work has also been performed to initiate Phase 4 as specified in the contract:

Phase IV. Implications for Sediment Diversions

15. Assemble estimates of the sediment quantities and calibers available for diversions planned to promote marsh and wetland restoration.
16. Develop best estimates of needed sediment loads, with appropriate error bars to represent uncertainty.
17. Identify seasonal windows for diverting sediment out of the river for marsh and wetland restoration purposes.

Specifically, meetings with USACE personnel and with habitat planning groups associated with local agencies have been undertaken. The result of these meetings was to acquire a planning-level model for computation of the sediment quantities needed for construction of wetland/marsh complex per area desired. A literature review has been conducted to establish a range of wetland/marsh complex that has been lost through time. Using the estimated range of wetland/marsh land lost with the planning level model allows computation the volume of sediment required of various grain sizes to replace lost.

The USGS, the agency for gathering most of the present water and sediment data, reported that no long term collection of sediment concentration is being performed at existing diversions. Data is available on the Mississippi River and for several of the existing marsh channels, however.

USACE, New Orleans District has provided the team with dredging records. This data has been collected for dredging in the Mississippi and Atchafalaya Rivers and includes dredging quantities and locations for the past several years. We understand that gradations of the dredge material are available, but this data has not yet been supplied to the team. As discussions with interested parties continue, the use of dredge material has become viewed as a viable source of material for marsh building. Dredge material is presently available, and only the added cost to deliver the material to the marsh-building site would be required.

Building the data base

During this reporting period, the inventory of known sediment load data was updated with assistance from USACE staff at ERDC-WES, the Vicksburg District, Vicksburg Division and New Orleans Division Offices (Annex 1). Continued efforts to track down the remaining data records (Annex 2) were partially successful. These efforts benefited from continued support and active engagement in the project by staff from the Coastal and Hydraulics Laboratory.

Statistical Analyses

A meeting was held at the Halcrow offices in Leeds to agree the range of statistical analyses to be employed in investigating the data. This meeting was attended by Professor Clifford of the University and Dr Harmar and Mr Measures of Halcrow. Final agreement was reached on how the statistical work will be approached and executed.

Following the meeting, a video conference was held. This was attended by Dr Harmar and Mr Measures (Halcrow), Professors Clifford and Thorne (Nottingham) and Dr Biedenharn (Cottonwood). At the conference progress was reviewed, current work reported and future work planned.

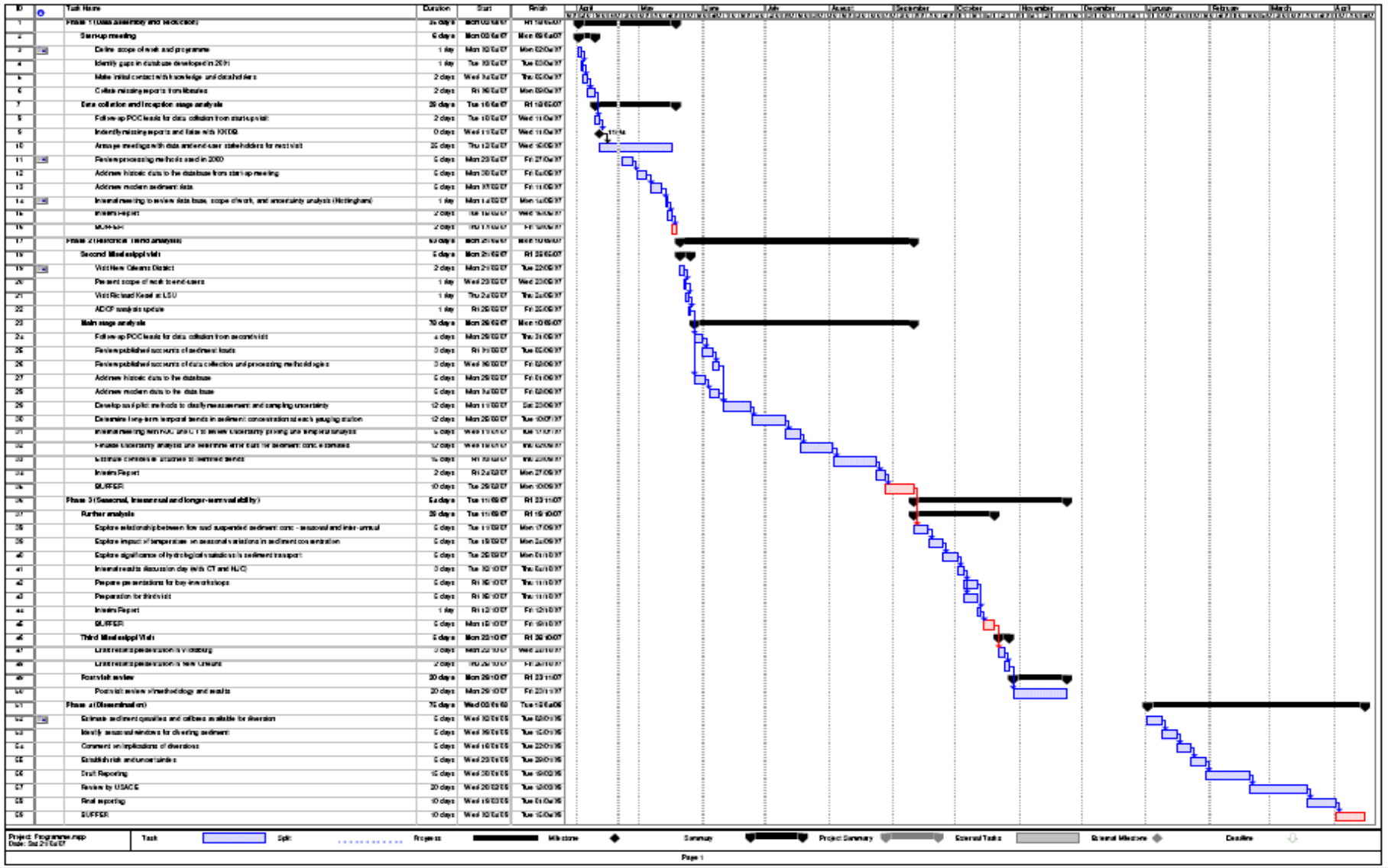
Plan for next Reporting Period

The next project reporting period is of only one month duration. During this period it is planned to continue work on the Tasks in Phase 2, while resolving the remaining issues from Phase 1. Phases 3 and 4 will be fully addressed in the final reporting period (October 2007 – March 2008).

Project variations

There were no project variations during this reporting period.

Annex 1. GANTT Chart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Task
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Progress
Milestone
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Annex 2. Data Inventory

Pre-1930s Datasets

Note: Only historic data we currently have digitally is the 1929-31 sediment load data published by Robbins (1977). This is the original data published in Papers H and U by the MRC (1930-32). However loads originally published in cubic yards were converted to tons/day by Robbins (1977)

Date from	Date to	Watercourse	Organisation	Location	Source	Description	Interval
1838	1838	Mississippi River	Head of Passes	Captain A Talcott	USACE, 1930 Paper H, Potamology Programme P1 Report	1 sample from southeast pass, 18 samples from SW Pass, ratio of mass of sediment to water	
1845	1845	Mississippi River	Three locations between Cairo and GOM	Professor Riddell	USACE, 1930 Paper H, Potamology Programme P1 Report	Four samples of water, ratio of mass of sediment to water, with qualitative stage information	
1846	1848	Mississippi River	Natchez	Mr Andrew Brown	USACE, 1930 Paper H, Potamology Programme P1 Report	ratio of mass of sediment to mass of water	
1849	1849	Mississippi River	Memphis	Lieutenenant R A Marr	USACE, 1930 Paper H, Potamology Programme P1 Report	April to June 1849 and March 1850 to March 1851	
1851	1853	Mississippi River	1851-1853 at Carollton, 1858 at Colombus	Humphreys and Abbott (1876)	USACE, 1930 Paper H, Potamology Programme P1 Report	See Humphreys and Abbot	
1879	1880	Mississippi River	various Locations - see below	Observations under Board of Engineers (Low Water Board)	USACE, 1930 Paper H, Potamology Programme P1 Report	Samples taken at surface, mid-depth and bottom of eight vertical points, located at equal distance across gauged cross-section	
1879	1880	Mississippi River	various Locations - see below	Observations under Direction of Mississippi River Commission	USACE, 1930 Paper H, Potamology Programme P1 Report	Samples taken at surface, mid-depth and bottom of eight vertical points, located at equal distance across gauged cross-section	

March 1858	Nov 1858	Mississippi River	Humphreys and Abbott	Colombus, 21 miles below Cairo	USACE, 1930 Paper H, Potamology Programme P1 Report	Surface concentration only	Mostly 2-3days
March 1879	July 1879	Mississippi River	Low Water Board	Colombus, 21 miles below Cairo	USACE, 1930 Paper H, Potamology Programme P1 Report	Surface, mid depth and bottom sediment concentrations	Mostly 2-3days
November 1879	October 1880	Mississippi River	MRC	Fulton, 175 miles below Cairo	USACE, 1930 Paper H, Potamology Programme P1 Report	Surface, mid depth and bottom sediment concentrations	2-3 days
January 1879	June 1879	Mississippi River	Low Water Board	Hampton Landing, 242 miles below Cairo	USACE, 1930 Paper H, Potamology Programme P1 Report	Surface, mid depth and bottom sediment concentrations and compositions	3-4 days
December 1878	June 1879	Mississippi River	Low Water Board	Helena, 306 miles below Cairo	USACE, 1930 Paper H, Potamology Programme P1 Report	Surface and some bottom sediment concentrations and compositions	3-7 days
November 1879	October 1880	Mississippi River	MRC	Lake Providence, 542 miles below Cairo	USACE, 1930 Paper H, Potamology Programme P1 Report	Surface, mid depth and bottom sediment concentrations	2 wks
January 1879	May 1879	Mississippi River	Low Water Board	Kings Point, 595 miles below Cairo	USACE, 1930 Paper H, Potamology Programme P1 Report	Surface, mid depth and bottom sediment concentrations and compositions	4 days
December 1879	October 1880	Mississippi River	MRC	Carrollton, 960 miles below Cairo	USACE, 1930 Paper H, Potamology Programme P1 Report	Surface, mid depth and bottom sediment concentrations	1-2 week

Post-1930 Data sets

Note:

black Digital Data available for study est = estimated

green Paper format data available - however digital data input would be required

Name of Gauging Station	Organisation	Filename	Dates	Interval
LOWER MISSISSIPPI RIVER				
Chester	USGS Sediment website	ChesterUSGSsed.xls	1980-1994	Daily
Memphis	USGS	MempUSGS.xls	1973-1994	4 wks
Arkansas City	USACE Vicksburg District	ArkDistrict.xls	1979-1998	wkly to monthly
	USACE Vicksburg District update		1998-2006	monthly
	Robbins (1977)	ArkRob.xls	1929-1931, 1967-1974	3 days to monthly
	Other	Ark6979.xls	1969-1979	Approx 2 wks
Vicksburg	USACE Vicksburg District	VickDistrict.xls	1979-1998	wkly to monthly
	USACE Vicksburg District update		1998-2006	monthly
	USGS	VickUSGS.xls	1973-1994	Irregular
	Robbins (1977)	VickRob.xls	1929-1931, 1967-1974	3 days to monthly
	Other	Vick6979.xls	1969-1979	Approx 2 wks
Natchez	USACE Vicksburg District	NatDistrict.xls	1979-1998	wkly to monthly
	USACE Vicksburg District update		1998-2006	monthly
		Nat6979.xls	1969-1979	Approx 2 wks
Coochie	USACE New Orleans District	CoocDistrict.xls	1967-1997	2 wks
Tarbet Landing	USACE New Orleans District	TarDistrict.xls	1974-1997	2 wks
	USACE New Orleans District update		1998-2005	2wks
			1963-1967	2 wks
	USACE New Orleans District paper summaries		1963-1973	2-4 wks (est)
	USACE New Orleans District paper originals		**1967-1970 and 1974**	**2-4 wks (est)**

Red River Landing	USACE New Orleans District	RedDistrict.xls	1973-1997	2 wks
	USACE New Orleans District paper originals		**1959-1963**	**2-4 wks (est)**
	USACE New Orleans District digital data		1959-62	Approx 1 wk
St Francisville	USGS	StFranUSGS.xls	1978-1993	2-4wks
Baton Rouge	USACE New Orleans District digital data		1956-1959	Daily
	USACE New Orleans District digital data		1954	Approx 2 wks
Donaldsville	**USACE New Orleans District paper originals**		**1949-51**	**2-4 wks (est)**
Other	Old River Study (USACE New Orleans District records?)		1949-69	Annual load
RED RIVER				
Alexandria	USACE New Orleans District	AlexDistrict.xls	1971-1979	approx 2 wks
	USGS	AlexUSGS.xls	1973-1995	Irregular
Madam Lee Revetment	USACE New Orleans District	MLRDistrict.xls	1992-1996	2 wks
OLD RIVER CONTROL				
Low Sill Outflow	USACE New Orleans District	LowSillDistict.xls	1989-1991	2 wks
Knox Landing (C-89)	USACE New Orleans District	KnoxDistrict.xls	1974-1997	2 wks
ATCHAFALAYA				
Melville	USGS	MelUSGS.xls	1978-1995	Daily
Simmesport	USACE New Orleans District	SimDistrict.xls	1950-1997	2 wks
	USGS	SimUSGS.xls	1972-1989	Daily
	Other	Sim6367.xls		